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ON THE REAL MOTIONS OF ONE HUNDRED STARS OF LARGE PROPER MOTION WHOSE RADIAL VELOCITIES HAVE BEEN DETERMINED.

BY R. E. WILSON.

In *Lick Observatory Bulletin*, No. 214, Professor H. C. WILSON presents the results of the computations of the apices of motion and absolute velocities in space of one hundred stars whose annual proper motions exceed 0″.4 and whose radial velocities have been determined. The list includes nearly all such stars, although there are a number with proper motions exceeding 0″.4 whose observed radial velocities are variable and as yet uninvestigated, which therefore could not be included in this discussion. For fifty of the stars fairly good determinations of parallax were found, mostly in KAPTEYN's list.[1] In order to include the fifty stars for which no parallaxes are available all the calculations were carried through with three assumed values of parallax. Generally the values chosen were $\pi = 0''.05$, $0''.10$ and $0''.20$; but where a published parallax did not fall within this range values greater and smaller than the observed parallax were assumed.

Charts showing the distribution, proper motions, and radial velocities of these stars reveal some interesting facts. These large proper-motion stars are pretty well distributed over the sky, being rather thinner along the Milky Way than elsewhere. A great many seem to have a common direction of motion. More than half are moving roughly in the direction $\alpha = 90°$, $\delta = +30°$. They do not converge toward the solar antapex at $\alpha = 90°$, $\delta = -30°$, but north of it. They do not converge toward any point, but toward a large area, perhaps 90° in diameter.

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[1] *Groningen Publications*, No. 24.

Charts of the apices and the range through which they pass under the *assumed* values of the parallax show clearly a tendency of the apices to arrange themselves along the Milky Way, in contradistinction to the stars themselves, which seem to shun this region. There is a manifest crowding of the apices in the region having its center at about $\alpha = 90^\circ$, $\delta = + 30$, showing a tendency on the part of this particular list of stars to move within 30° of a common direction toward

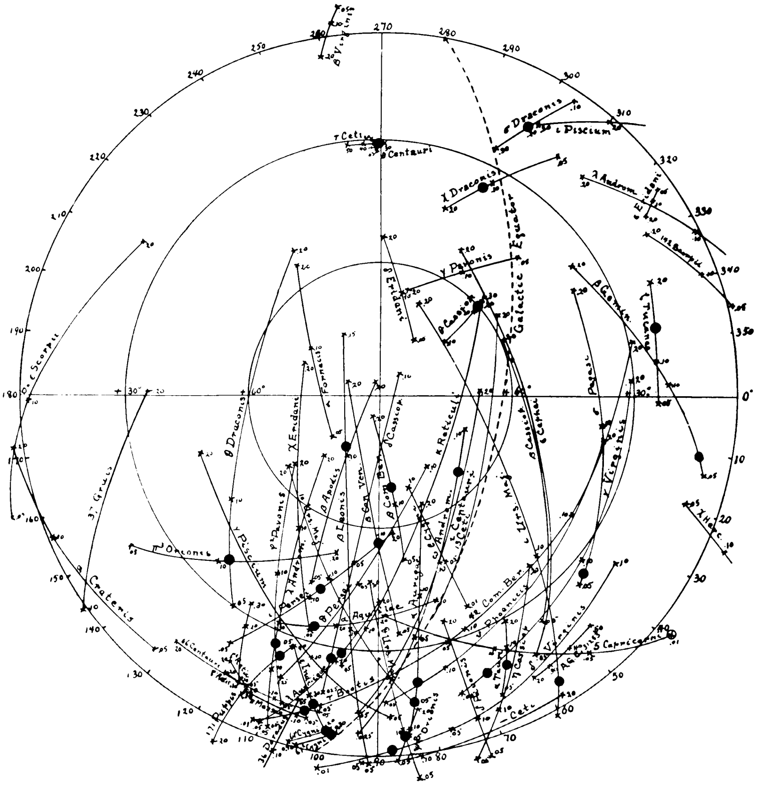

DIAGRAM SHOWING THE GROUPING OF THE DIRECTIONS OF STELLAR MOTIONS IN THE NORTHERN HEMISPHERE.[1]

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[1] The black circles show the apices of the stars whose parallaxes are known. The curved lines connect the computed apices corresponding to the three assumed values of parallax.

a point near the conjunction of the constellations *Gemini* and *Taurus.* There are less marked indications of clusterings of the apices in the opposite part of the sky, around the point $\alpha = 270°$, $\delta = -30°$, and in the region about $\alpha = 110°$, $\delta = +40°$. It is interesting to note that the apex of Professor Boss's *Taurus* stream of stars and Kapteyn's vertex of preferential motion are near the center of the first region, while the apex of the *Ursa Major* stream is in the second. Using Lick Observatory values of the radial velocities of eight *Taurus* stars, Professor Wilson finds the absolute velocity of the *Taurus* stream to be 31.0 kilometers per second, instead of 32.0 kilometers, the value computed from Professor Boss's parallax of the stream. The best position of the apex seems to be at $\alpha = 95°.5$, $\delta = +29°.5$.

The computations of the absolute velocities of the stars show that there are a few "runaway" stars, for which no probable adjustment of parallax will bring the velocity below 100 kilometers per second. The two swiftest-moving stars are *Groombridge* 1830, with a velocity of 285 kilometers per second, and *Cordoba Zones* $5^h.243$, with a velocity of 260 kilometers. For forty-six stars the average velocity comes out 55 kilometers. When they are arranged according to spectral classes, as in the table below, it is clear that for these stars the absolute velocities vary with the spectral class, the velocity of the star increasing with its effective age, a fact which was pointed out with reference to radial velocities by Professor Campbell in 1910.

Class.	Number of Stars.	Average Velocity.
A	6	25.2^{km}
F	15	45.7
G	15	72.3
K	10	60.5

The number of stars in each group is small, so that the averages are quite uncertain. However, every one of the stars in Class A has a velocity of less than 40 kilometers, while seven of the fifteen in Class F, ten of the fifteen in Class G, and seven of the ten in Class K have velocities greater than 40 kilometers.

A later table gives the average velocities of the stars of the different classes under the three assumed values of parallax.

	$\pi = 0''.05$		$\pi = 0''.10$		$\pi = 0''.20$	
Class.	No. Stars.	Ave. Vel.	No. Stars.	Ave. Vel.	No. Stars.	Ave. Vel.
A	4	27.8^{km}	6	17.8^{km}	5	16.2^{km}
F	28	63.2	29	33.9	27	25.3
G	22	86.1	27	63.8	26	43.9
K	24	73.0	26	52.3	27	44.4

This table shows clearly the effect of erroneous parallax upon the calculated velocity. The variation of velocity with the class of spectrum is also shown under all three assumptions of parallax. The average velocity corresponding to a parallax of $0''.10$ comes out 51 kilometers. This agrees well with the results obtained by Professor Dyson, who estimated the average velocity of stars of large proper motion at 50 kilometers. For the ten stars having annual proper motions of $2''$ and over, the average velocity comes out about 130 kilometers and the average parallax $0''.27$. This shows that their excessive proper motion is due not only to relative proximity to the Sun, but also to really more rapid motion as compared with the other stars.

The latter part of the paper is taken up with a discussion of the connection of a number of the stars with the *Taurus* stream and with Mr. Benjamin Boss's 61 *Cygni* group of stars. Assuming a common velocity and apex, it is simple to compute the position-angle, proper motion, and velocity of each individual star. The size of the residuals from the observed and computed values of these co-ordinates forms the basis of argument as to the connection of the stars with a particular group. Professor Wilson finds evidence that fourteen of the stars under discussion may be members of the *Taurus* stream and five of them probably belong to the 61 *Cygni* group. He thinks the data do not warrant the conclusion that there is close parallelism of motion or absolute equality except in isolated cases, but there are certainly preferential directions and approximate equality of velocities among groups of widely scattered stars.